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The Cement Mill Edition of *Concrete*

The Cement Mill Edition of CONCRETE is edited exclusively for those interested in the manufacture of portland cement and related products.

Its pages are devoted to discussions of plant design, management, operation, production efficiency, chemical research and control, quarry operation, progress and news of the industry.

The Cement Mill Edition also contains all the material published in the corresponding Regular Edition and so provides news of the uses and merchandising of the materials whose manufacture is discussed in the Mill Edition.

The Regular Section furnishes mill operating officials and mill executives valuable points of contact with the users of the materials they produce.

Charter Member

Audit Bureau of Circulations

CEMENT MILL SECTION of Concrete

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Cement Mill Section of
Concrete

DECEMBER
1933

High-Strength and Masonry Cements Produced by New Process

Proportions Easily Varied to Meet Service Requirements—Control Simplified and Costs Lowered—Heat of Hardening Greatly Decreased

By **ALTON J. BLANK**
General Superintendent and Supervising Chemist, Compania de Cemento Portland "Landa," S. A.,[1] Puebla, Mexico

DURING the past twenty years there has been an increasing demand on the part of the public for new and improved cements, and in attempting to meet a few of the demands placed upon him, the portland cement manufacturer has been put to the maximum of expense for which he has received a minimum of thanks.

The rising demand on the part of the public for quick-hardening, high-early-strength cement has led the manufacturer on an extended wild goose chase that has left a number of the old and obsolete plants abandoned in its wake. It has resulted in the necessity for him to develop and buy new and expensive types of kilns and processing equipment, and has forced him into the production of new and improved portland cements which met the primary demands of the public, but which, he was soon to learn, seldom met the ultimate demands of this same public.

High Lime and High Early Strength

Thus the average cement manufacturer, in order to satisfy the demand for cements of super quality, found upon extensive research that his one, if not only, hope for the production of this type of cement lay in increasing its lime content considerably and grinding the cement to a considerably greater fineness than he had theretofore attained.

To accomplish this end he required new equipment and improvements in his existing installation. He found that he must have more exacting methods for the control of the composition of his raw materials, and that he must grind these raw materials very fine. He also learned that, in order to get a sound product, he must burn the clinker very hard and grind it very fine. Each of these steps cost a large sum in new equipment, in increased fuel and power consumption, and in decreased plant capacities, with consequent higher labor costs; yet he felt that now he was giving the public all it had asked for in the higher quality of his improved cement.

The manufacturer and his chemist were somewhat vaguely troubled about the improved cements, and wondered whether they had not gone a little too fast and were producing something that was a little outside their knowl-

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[1] Also Director of Research, Cement Process Corporation.

Table 1—Summary of Mill-Scale Tests of

		MATERIALS[1]			PRODUCT						
					Chemical Tests (per cent)						
Test	Duration of Test (hr.)	Caustic Lime	Siliceous or Argillaceous	Amount of Clinker (per cent by weight)	SiO_2	R_2O_3	CaO	MgO	SO_3	Ignition Loss	Insoluble Residue
186-A	10	No. 5 mesh and less	Moist river sand	70	22.00	9.60	60.45	1.22	1.95	4.50	9.22
186-B				60	23.60	9.76	58.78	1.18	1.82	3.80	12.50
186-C				50	24.58	10.84	53.61	1.07	1.48	7.70	14.78
127-A	8	No. 4 mesh and less	Moist field clay	50	22.46	9.94	62.64	1.05	1.27	1.20	10.90
127-B				50	24.40	10.60	58.01	1.07	1.41	4.00	13.20
127-C				50	28.00	11.20	53.07	1.22	1.48	4.10	18.50
147-A	10	No. 4 mesh and less	Moist river sand	8	19.20	9.00	61.88	0.86	0.37	8.50	17.50
147-B				8	22.00	9.40	57.20	0.92	0.62	9.60	24.10
147-C				8	24.40	10.20	53.25	1.08	0.68	9.90	27.30

[1] Proportions of lime and sand and of lime and clay varied somewhat in all tests.

edge that might react and cause trouble at a later date.

Their hopes and fears were well founded. Only a few years passed before they were confronted with a number of disquieting problems, all of which could be answered, but none of which could be solved without departing materially from the generalized control and process of manufacture that had been built up after considerable research and at much expense.

The first question put to producers was in connection with the ultimate quality and durability of concrete made from the new high-lime cements. Before a great deal of time had passed a number of failures of concrete were actually placed at the door of high-lime cements.

Among a certain school of thought the high early strength of portland cement is due to tricalcium silicate. Thus, the higher the tricalcium silicate content of a cement, the higher will be the early strength; in fact, cements of this type may attain the greater part of their strength within a few weeks. High-lime cements naturally contain high percentages of tricalcium silicate. Thus, for the manufacturer to meet the demands of the public for high-early-strength cement, he must from force of necessity manufacture a high-lime cement, and in so doing he gives the public the high early strength it desires, but at the expense of durability. To give the public the durability it desires the manufacturer must, on the other hand, sacrifice the high-early-strength feature of his product, so he continues to give it one or the other, but not both of the quality features it desires.

Heat of Hardening Creates New Problem

Before the first question was satisfactorily answered, another of minor, yet considerable, importance arose. The producer was confronted with a new problem pertaining to the high heat of hardening of concrete made from the improved high-early-strength, though incidentally high-lime, cements. Extensive studies made upon cements have developed the facts that high or low heat of hardening is indicative of high or low strength of the cement, and that the tricalcium-silicate constituent of cement ranks second in the liberation of heat. Thus, the higher the strength of a cement at early ages, the higher the tricalcium-silicate content and, naturally, the higher the lime content. Reducing the tricalcium-silicate content in the cement reduces the heat of hardening of the cement but has the disadvantage of decreasing the strength at the same time. Thus, high strength must in part be abolished in order that low heat of hardening may be attained.

It has also been found that cements having the higher finenesses have the higher heat of hardening; but to lower the fineness of a cement is to sacrifice early strength. On the other hand, the harder-burned cements have the higher heat of hardening, and to burn these cements not so hard results in cements of not so good a quality.

Thus, to meet the demand of the public for high-early-strength cement the manufacturer gives it a cement having a high heat of hardening, something which it does not want. He is again placed in the position where he can give one or the other, but not both the quality features that are desired.

New Field Developed

A new field for cements adaptable to a variety of uses has therefore been opened, and in the development of new processes of manufacturing these cements great advantages for the producer and the public alike are to be found. The process in question consists in the hydration of lime in the presence of siliceous or argillaceous materials under controlled moisture, temperature and grinding conditions; or hydrated lime may be intimately mixed and ground with siliceous or argillaceous materials under controlled moisture, temperature and grinding conditions.

The resulting products may be classified as masonry cements, as equal to present portland and high-early-strength cements, this depending upon the materials used, their proportioning, and the control exercised in the manufacturing process. In certain cases the use of varying amounts of portland cement clinker or cement is necessary to give the desired results. This addition is made after the hydration process but previous to the final grinding.

It has been found that any raw material adaptable for use in the manufacture of portland cement can be used in the new process. Thus limestone, both pure and impure, and cement rock may be used on the one hand with clay, shale, slag, sand, diatomaceous earth, tripoli and other siliceous and argillaceous materials.

The New Manufacturing Process

The process, as now in use at the plant of the Landa Portland Cement Co., Puebla, Mexico, in the manufacture of its new brand of "Atoyac" cement and in its new masonry cement "Plastocement," can be described roughly as follows:

Caustic lime, as discharged from the rotary kiln in

Various Forms of "Plastocement" and "Atoyac"

OF MILL

Physical Tests					TENSILE STRENGTH OF MORTAR (1:3 Sand) at Various Ages (lb. per sq. in.)			
Normal Consistency (per cent)	Initial Set (hr. and min.)	Final Set (hr. and min.)	Fineness, per cent through 200-mesh screen	Specific Gravity	24 Hr.	3 Days	7 Days	28 Days
28.0	1:30	3:35	99.5	2.92	286	350	392	542
26.0	2:00	3:55	93.0	2.88	224	351	405	509
26.0	2:10	4:20	90.0	2.82	198	308	348	425
26.5	1:15	2:25	97.5	2.86	290	354	379	436
28.0	1:30	3:10	98.5	2.93	269	293	364	476
28.0	1:10	2:40	99.0	2.94	167	262	328	463
30.0	1:40	3:25	98.0	2.64	99	123	189	306
34.0	2:30	5:00	96.5	2.66	87	129	172	309
37.5	2:45	5:30	98.0	2.69	79	108	148	288

sizes from 2 in. and down, is passed through an ordinary hammer-mill and reduced to around No. 4 mesh size and down, and discharged into an elevator. River sand, in its moist state, is fed by a poidometer belt and is discharged into the common elevator. The common elevator in turn discharges the mixture of caustic lime and river sand into a screw-type hydrator, at which point a gauged amount of water is added to the mixture to insure hydration of the lime and proper reaction of the lime with the sand, the co-mixture being passed through the 100-ft. length of the hydrator and discharged into the feed screw of a standard tube mill, and ground to a fineness of above 90 per cent passing the 200-mesh screen, under controlled moisture and temperature conditions.

Clinker Acts as Catalyzer

In the production of the masonry cement "Plastocement" there is added approximately 8 per cent of clinker to the initial 75 per cent caustic lime and 25 per cent sand mixture on its entrance to the mill, this clinker acting as a catalyzer and insuring further reactions between the constituents of the product during the fine-grinding process in the mill, where the temperature of the resulting product is kept in the neighborhood of 125 deg. C. The resulting masonry cement has the highest quality for cements of its kind and is not only adaptable for use as mortar for bricklaying, but is also used as both rough and smooth hard-wall plaster, and as stucco, being extremely plastic and having good strength and spreading properties. The volume of the material is some 50 per cent greater than that of portland cement per given weight.

For Stucco and Brick Mortar

Only one brand of masonry cement, namely, "Plastocement," is being manufactured by the Landa company at this time, since the one product was developed to meet the requirements for both a brick mortar and a wall plaster or stucco. Whereas a product manufactured under the process from a 75 per cent sand and 25 per cent caustic lime and water composition is found to give a most excellent brick-mortar material, the product is not quite plastic enough for a wall-plastering material. Thus the reverse composition is utilized to serve both brick-mortar and wall-plastering requirements.

With the use of certain clays instead of sand it is found that an addition of as little as 5 per cent of portland cement clinker included in the mixture has the desired effect as a catalyzer, while with the use of diatomite and other extremely finely divided silicates an even lower proportion of clinker is required to develop a high-grade masonry cement.

High-Strength Cement of Same Composition as Portland

"Atoyac" cement, which is manufactured under the same process, and which has been placed on the market in direct competition with the standard Landa portland cement, is produced from a 75 per cent sand and 25 per cent caustic lime and water mixture subjected to the same moisture, temperature and grinding control as above, and to this mixture (previous to the final grinding stage) there is added approximately 65 per cent portland cement clinker as a catalyzer.

The new cement, as well as "Plastocement," has the same chemical composition as standard portland cement and has normal setting properties. The new cement is of somewhat higher quality than the standard portland cement, inasmuch as it has a higher initial strength and a marked increase in strength with age over that obtained with portland.

Properties of New Cement

Added advantages are plasticity, low heat of hardening, waterproofing properties, low volume changes and somewhat greater bulk per given weight than is had with portland cement. The new cement passes the specifications for portland cement by a wide margin and differs from the specifications for portland cement only in so far as its insoluble-residue content and the specification definition are concerned.

By varying the kinds and amounts of materials used in the process, together with the control procedure of manufacture and the amount of clinker used to give the desired catalyzing effects, it is possible to produce a great number of cements for a variety of uses, including those which surpass the standard portland cement and which equal the best of the so-called "super" cements. The simplicity of the process, together with the extreme variety of raw materials that may be used, results in products that may be produced at a distinct economy compared with present production methods in the cement industry.

The portland cement clinker used in the manufacture of the new products need not be extremely hard-burned, since it has been found that a slightly underburned clinker gives very good results.

At the same time extremely low-lime clinker, as well as the higher-lime clinker, is found to give the desired effect when used as a catalyzer.

In the development of the process in question several years of experimental work were carried out by the research staff of the Cement Process Corp. at the plant of the Landa Portland Cement Co., at Puebla, Mexico, including hundreds of tests made in the plant on a mill scale of operations, and thousands of laboratory and field tests made upon the finished products.

A few of the mill-scale tests and allied data are shown in Table 1.

Mill Temperatures

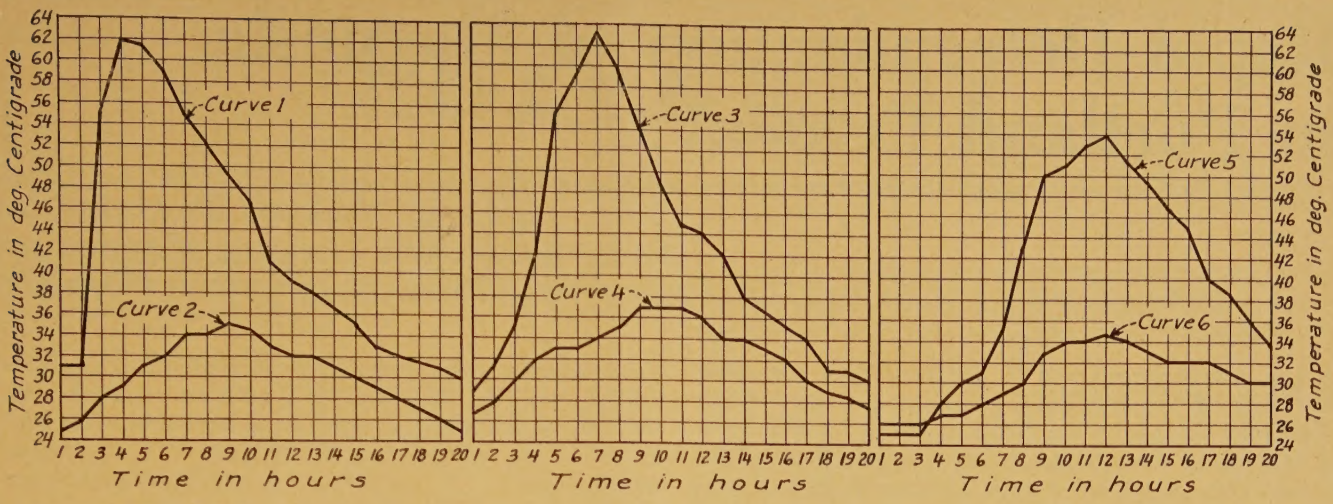
In the manufacture of "Atoyac" cement the mill temperature is controlled usually within the limits of 135 to 170 deg. C., and in the production of the masonry cement, "Plastocement," the temperature is usually kept in the neighborhood of 110 to 140 deg. C.

In the production of both cements it is found that the better results in the quality of the product are attainable at the higher temperatures, this also being true with the higher finenesses of the finished products.

River Sand Is Cheapest Raw Material

In the production of "Atoyac" cement the materials and procedure as outlined in Test No. 186 are more or less followed in obtaining a product considerably better than the standard portland cement. Sand is being used in preference to clay and other siliceous and argillaceous materials, due to its extreme cheapness as a raw material and due to the large deposits found in the vicinity of the plant. Other siliceous and argillaceous materials are found to give results equal to or better than those obtained with river sand.

Thus it is seen that all types of materials of calcareous,



Curves 1, 3 and 5 show rise in temperature, during hardening period, of three standard portland cements. Curves 2, 4 and 6 show much lower temperatures, developed during hardening, of new process cements

siliceous and argillaceous nature are suitable for use in the manufacture of a variety of products by means of the newer process outlined.

New Process, New Opportunities

While the process is to be considered as taking a definite step away from that of portland cement manufacture, it is readily seen that such a process, under which many kinds of product can be manufactured for specified uses, has opened a new field with equal advantage to the cement producer and the public. It allows the old type of existing cement plant to compete on equal terms with the more modern plant and allows the cement and lime industries to operate hand in hand toward the production and marketing of new and improved products, resulting in economy to the producer and increased quality of products for the public.

It also allows the producer to manufacture high-early-strength cements which have a low heat of hardening and a continued increase in strength with age, thus meeting the objection of the public to several of the features present in cements of that kind as at present manufactured.

Explanation of Diagrams

Curve 1 in the diagram shows the rise in temperature of a standard portland cement during its hardening period. Curve 2 shows the lower heat of hydration of the new "Atoyac" cement which was manufactured by using 65 per cent of the cement in question in combination with a normal caustic lime-sand-water mixture under the new process.

Curve 3 shows the rise in temperature of a second standard portland cement during its hardening period, while Curve 4 shows the lower heat of hydration of the new "Atoyac" cement which was manufactured by using 60 per cent of the cement in question in connection with a normal caustic lime-sand-water mixture under the new process.

Curve 5 shows the rise in temperature of a third standard portland cement especially manufactured so as to have a lower heat of hydration, while Curve 6 shows the lower heat of hydration of the new "Atoyac" cement which was manufactured by using 70 per cent of the cement in question in connection with the normal caustic lime-sand-water mixture under the new process.

Thus, there is opened a new and undeveloped field of new products for the cement manufacturer with production costs decidedly lower than heretofore thought possible, while on the other hand the demand of the public for a variety of products that will meet all its specifications can be filled.

Advances Date of Annual Meeting

To make it possible for its members conveniently to attend the Fourteenth Exposition of Chemical Industries, which is to be held at Grand Central Palace in New York City, December 4 to 9, 1933, the *American Institute of Chemical Engineers* has changed the dates of its national meeting.

The meeting of the Institute will now be held December 12, 13, and 14, instead of December 6, 7, and 8. The place of the meeting is unchanged, namely, Roanoke, Virginia.

Mental Training for Safety

Dr. Hulbert's four psychology lectures, given during the 22nd Annual Safety Congress, have been printed, and copies are available. These lectures, presented under the title of "Mental Training for Safety"—a 32-page booklet —may be secured from the headquarters of the National Safety Council, Chicago, in quantities for distribution to executives, foremen, safety committeemen and others. The prices are:

1 to 25 copies	20c each
26 to 100 copies	15c each
101 to 500 copies	12c each
501 copies and over	10c each

The thought advocated by Dr. Hulbert will help convince the man on the job that the principles of accident prevention are reasonable and should be followed.

Twelve new safety instruction cards have been issued, making the total number now available of 124, all containing practical safety information for the man on the job.

Keystone Address

The Keystone Portland Cement Co. announce the removal of their general offices to 1400 South Penn Square, Girard Trust Bldg., Philadelphia, Pa.

Rapid Determination of Magnesia in Portland Cement

Former Methods Shortened by Precipitating and Titrating Magnesium Oxyquinolate in Presence of Calcium Oxalate

DATA here presented show that magnesium oxyquinolate can be precipitated and titrated in the presence of calcium oxalate. A rapid method for the determination of magnesium in portland cements is described in this article, abstracted from a paper by John C. Redmond in Bureau of Standards *Journal of Research*, June, 1933.

Work of Various Experimenters

A rapid and accurate method for the determination of magnesia in portland cements and similar materials by the use of 8-hydroxyquinoline was described by Redmond and Bright[1] in 1931. In this procedure, which has been in use for the routine analysis of portland cements at the Bureau of Standards for several years, the sample is dissolved in dilute hydrochloric acid, the R_2O_3 group and calcium are removed as usual, and magnesium then determined by precipitating with 8-hydroxyquinoline,[2] dissolving the precipitate in acid, and titrating with a standard bromate solution. This method can be further shortened by omitting removal of the calcium oxalate and precipitating and titrating the magnesium oxyquinolate in the presence of the calcium oxalate.

Shead and Valla[3] claim that magnesium oxyquinolate can be precipitated in the presence of calcium oxalate. In their method the combined precipitates of calcium oxalate and magnesium oxyquinolate are ignited, weighed, and lime subsequently determined by the saccharate method. Bucherer and Meier[4] have described a method wherein the magnesium oxyquinolate is precipitated in the presence of calcium oxalate, and magnesium determined by their "filtration method."

RAPID DETERMINATION OF MAGNESIA

The method recommended for the rapid determination of magnesia in portland cement is given in the paragraphs that follow.

The solutions used in this procedure and their methods of preparation are those described by Redmond and Bright,[1] with the exception of the method of standardization of the bromate-bromide solution. This is made as follows: To 200 ml of water in a 400-ml beaker add exactly 25 ml of the potassium bromate-potassium-bromide solution (0.2 *N*). Add 20 ml of hydrochloric acid (specific gravity 1.18), stir, and add immediately 10 ml of potassium iodide solution (25 per cent). Mix well, and titrate at once with standard sodium thiosulphate solution (0.1 *N*) until nearly colorless. Add 2 ml of starch solution and titrate to the disappearance of the blue color.

Procedure

To a 0.500 g sample in a 400-ml beaker add 10 ml of water and 10 ml of hydrochloric acid (specific gravity 1.18). Heat gently and grind any coarse particles with the flattened end of a glass rod until decomposition is complete. Dilute to 150 ml with hot water.

To the solution add three drops of methyl red (0.02 per cent alcoholic solution), and then ammonium hydroxide (specific gravity 0.90) until the solution is distinctly yellow. Add macerated filter paper, and heat to boiling. Boil from 1 to 2 minutes, remove from the hot plate, and allow to stand until the precipitate has settled. Filter without delay, and wash the precipitate with a hot 2 per cent solution of ammonium chloride. To the filtrate add 1 ml of ammonium hydroxide (specific gravity 0.90), and heat to boiling. When boiling, add 25 ml of a hot 4 per cent solution of $(NH_4)_2CO_4.H_2O$ and continue boiling for 2 minutes. Digest on the steam-bath for 10 to 15 minutes.

Cool the solution to 70 deg. C., add 20 ml of a clear 1.25 per cent solution of 8-hydroxyquinoline (25 g of the reagent dissolved in 60 ml of glacial acetic acid and diluted to 2 liters with water), and then 4 ml of ammonium hydroxide (specific gravity 0.90) per 100 ml of solution. Stir on a mechanical stirring machine for 15 minutes, and set aside until the precipitate has settled. Filter, and wash with hot dilute ammonium hydroxide $(1+40)$. Dissolve the precipitate in 50 to 75 ml of hot dilute hydrochloric acid $(1+9)$, dilute the resulting solution to 200 ml, and add 15 ml of hydrochloric acid (specific gravity 1.18). Cool to 25 deg. C., and add from a pipette 25 ml of standard bromate-bromide solution (0.2 *N*). Stir and let stand for about 30 seconds to insure complete bromination. Add 10 ml of potassium iodide solution (25 per cent), stir well, and then titrate with standard sodium thiosulphate solution (0.1 *N*) until the color of the iodide becomes faintly yellow. At this point add 2 ml of starch solution and titrate to the disappearance of the blue color.

The percentage of magnesia in a 0.5 g sample may be calculated as follows:

A=g of MgO per ml of standard sodium thiosulphate solution.

B=ml of standard sodium thiosulphate solution equivalent to 25 ml of standard bromate solution.

C=ml of sodium thiosulphate solution required in the titration.

Then

$(B-C)\times A=$g of MgO.

g of MgO$\times 200=$per cent of MgO.

---

[1] Redmond, J. C., and Bright, H. A., *B.S. Jour. Research*, vol. 6, pp. 113-120, 1931. CONCRETE, July, 1931, p. 65.

[2] Berg, R., *Z. anal. Chem.*, vol. 71, p. 23, 1927.

[3] Shead, A. C., and Valla, R. K., *Ind. Eng. Chem.* Anal. ed., vol. 4, p. 246, 1932.

[4] Bucherer, H. Th., and Meier, F. W., *Z. anal. Chem.*, vol. 82, pp. 1 to 44, 1930.

EDITORIAL

Michigan Taxpayers to Get Three Cents on Dollar

MICHIGAN taxpayers may get from 3 to 3½ cents on the dollar in return for their investment of a cool million in a state business venture which in this instance took the form of a cement manufacturing plant at Chelsea.

Back in September the state administrative board took bids on the plant, acting under the authority of a law passed by the state legislature in 1931. The highest bid received at that time was $30,000. Acceptance of the bid would have meant a realization of 3 cents on the dollar; but even at that sacrifice the taxpayers would have been the gainers, for they would have been relieved of otherwise inescapable charges such as insurance and care-taking.

The September bids were rejected, and new bids opened on November 7 brought an offer of $35,000, or 3½ cents on the dollar. It is probable that this bid will also be rejected, and that the plant will be dismantled and sold piecemeal.

One can sympathize with the present state administration in its inclination toward the idea of dismantling the plant and selling it as junk or second-hand equipment, rather than disposing of the entire establishment in a lump sum. After all, the present state administration had no part in the acquisition of this unprofitable venture, though now it has the unpleasant duty of getting rid of the white elephant. Through separate sales of various pieces of machinery and equipment the disposal of the plant becomes less spectacular, and consequently less painful to state officials.

This state-owned cement plant was acquired by lease in 1923, followed by outright purchase in 1928, at a price of $625,000. An analysis of the plant's record, made by Guy H. Jenkins and published in the Grand Rapids Press of September 28, 1932, indicates that improvements and plant additions brought the total investment up to about $1,000,000. An article on pages 90-91 of the May (1931) "Cement Mill Edition" of "Concrete" places the total capital outlay at $766,000, but this latter figure takes no account of the annual operating deficit which the taxpayers had to make good.

The Chelsea cement plant constitutes a classic example of the futility of attempting state operation of an industrial enterprise. The venture had the usual history. Prison labor was employed. For six or eight years the public was led to believe that the plant was making a profit, this magic trick having been performed through the familiar old practice of omitting accounting charges that should have been placed against operations. By 1931, however, the true situation had become a matter of common knowledge, and in that year the state legislature passed a law calling for discontinuance of operations, and ultimate sale or scrapping of the plant.

In spite of this typical failure in Michigan, agitation favoring a state-owned cement plant crops up at intervals in several near-by states; but with Michigan's experience as a demonstration of actual performance, legislatures are not so easily deceived as they were formerly.

A Broader Cement Market

THE annual meeting of the Portland Cement Association, held in Chicago on November 20, 21 and 22, proved an inspiration to the cement manufacturing industry in more ways than one.

Most encouraging of all the phases of the gathering was the vision of broader markets through the promotion of additional uses for cement and concrete.

In fields of construction such as the railway systems of the United States, where concrete has been used in large volume for many years, it was shown that this market has been developed to a very small extent when compared with its potential volume.

In low-cost secondary road construction lies another opportunity for a greatly increased market for cement, in construction of the ordinary concrete slab type as well as the cement-bound macadam type. Here is a development that should offset the decline in primary highway construction, which, in some states, is slowly approaching the point of saturation.

Fireproof homes, now a comparative newcomer so far as volume of market is concerned, should in due time be one of the important factors. Here the problem is that of changing building habits of long standing. It will be a difficult market to develop, but when once developed it will be in the picture for a long period of time.

Architectural concrete, likewise, is visualized as a slowly increasing market, perhaps of moderate volume, but contributing a substantial amount to the total.

Then there is the small contractor market, the concrete products plants and the six million farms in the United States, all having possibilities far beyond anything thus far developed.

To all these may be added a number of miscellaneous uses of concrete which have scarcely been touched—all awaiting further development.

The whole picture is an impressive one, for it visualizes a broad market expansion, even extending into territories not yet explored.

Keep Cement Industry Young With Growing New Markets

Thirty-first Annual Meeting Told of Aggressive Program — Plan Economical Design of Concrete Highways—Railway Uses, Products and Housing, the Small Contractor, Cast Stone and Architectural Concrete Seen as Further Market Outlets

THE Portland Cement Association's thirty-first annual meeting at the Blackstone Hotel, Chicago, on November 20, 21 and 22, drew a nationwide attendance of cement men from the Atlantic seaboard to the Pacific Coast.

The morning and afternoon sessions on November 21, in which technical and promotional papers and talks were presented, was declared to have been one of the most valuable sessions in the history of the industry.

Development Work Urged

Notable among the papers delivered was that of E. J. Mehren, president of the Association, on "Keeping the Industry Young." Development work was the keynote of his address—developing new markets for cement simultaneously with the exploitation of present markets. Forty per cent of the sales of the General Electric Company in 1932 were products developed by that organization's research laboratories since the world war. Where would General Electric be without that development work?

Architectural Concrete

The use of concrete for decorative purposes was the subject matter of a talk by John J. Earley, architectural sculptor, Washington, D. C. Some of his more recent work was presented in the form of panels shown in an exhibit. A. J. Boase, manager of the structural bureau of the Portland Cement Association, discussed monolithic concrete as an architectural medium, showing panels and illustrations as practical demonstrations of the beauty in concrete.

Another notable paper on architectural concrete was presented during the morning session by P. C. Van Zandt, vice-president in charge of operations, Universal Atlas Cement Company.

Housing, Railway and Products Markets

Fireproof floors for low-cost homes were discussed by E. W. Dienhart, of the cement products bureau of the Association. As a part of his presentation he assembled a full-size section of a floor, showing one of the approved methods of constructing a floor of the reinforced joist type. The general market possibilities lying almost dormant in the housing field were discussed by W. D. M. Allan, director of promotion for the Association.

A. C. Irwin, manager of the railways bureau, presented the possibilities of the railroad market, in a talk illustrated by means of a large exhibit showing the uses of concrete in railway structures and roadbeds.

W. G. Kaiser, manager of the cement products bureau, told of the work of that bureau, while C. G. Walker explained the method developed through the medium of the Cast Stone Institute whereby cast stone may definitely be specified as to color and technique.

Developments in the highway promotional program were explained by Frank T. Sheets, consulting engineer for the Association. Primarily, the plan in this department visualizes "a road for every load"—that is, highways are to be designed for the present and prospective loads they are to carry. Highway engineers who adhere to this principle will not require cross-sections and gradients suited to metropolitan traffic, when designing slabs for secondary or light-traffic roads in remote rural sections.

Road Slabs Must Be Designed

In explanation, Mr. Sheets stated that this progressive step was taken after an extensive analysis of data on all matters having to do with pavement construction and traffic loads. He emphasized the point that no highway engineer would build for ordinary highway service a bridge capable of carrying the heaviest railroad loadings, nor would highway loads be a proper criterion for a railway bridge design.

A pavement slab is an engineering structure. It is capable of almost as exact analysis as bridges and other structures. Yet we commonly see pavement cross-sections suitable for the heaviest primary road traffic used indiscriminately on roads of medium or light traffic. We also see inadequate designs subjected to heavy duty service. This is a wasteful and unscientific practice.

Book for Highway Designing Engineers

As a means of aiding highway engineers in arriving at a rational design for a highway slab, the Association has just published a 61-page book entitled "Concrete Road Design," which will be given wide distribution. A review of this excellent publication appears elsewhere in this issue of CONCRETE.

Coffin Is Chairman of Board

George F. Coffin, secretary-treasurer and general manager of the Nazareth Cement Company, Nazareth, Pennsylvania, was elected chairman of the board of directors for the coming year. Edward J. Mehren continues as president.

B. F. Affleck, president of the Universal Atlas Cement Company, of Chicago, was elected treasurer and S. W. Storey, vice-president of Trinity Portland Cement Company, of Chicago, becomes a member of the board of directors.

Precautions Against Wild Shots in Quarry Blasting

Shots Due to Faults in Rock—Limestone and Dolomite Are Worst Offenders—Men and Machinery Should Be Under Cover or Protected

A WILD shot may be defined as a blast, usually in a quarry, that throws the rock, or a small proportion of it, much farther than was expected and much farther than the bulk of the material blasted. This does not mean a damaging blast which results from poor judgment in loading.

The Worst Offenders

Limestone and dolomite seem to be the chief offenders, although a weak spot is likely to occur in almost any kind of rock. A hidden weakness, extending back to the explosive charge, creates a condition somewhat like the bore of a cannon with a charge of powder and a projectile. In this case the cannon is represented by the mass of rock; the bore, by the stratifications or slips in the rock; the projectile, by the material enclosed within these planes, and the powder charge, by the dynamite in the borehole.

Of course, there are conditions likely to cause wild shots other than those just outlined. In some kinds of limestone, caves and small caverns exist which, unknown to the blaster, may become filled with dynamite to an extent greater than the burden calls for. The proximity of a mud seam in a certain class of material makes a weak place, although usually this is less dangerous, for the charge generally blows out at the side. There is more chance of a wild shot in bench shooting than in well-drill or tunnel shooting.

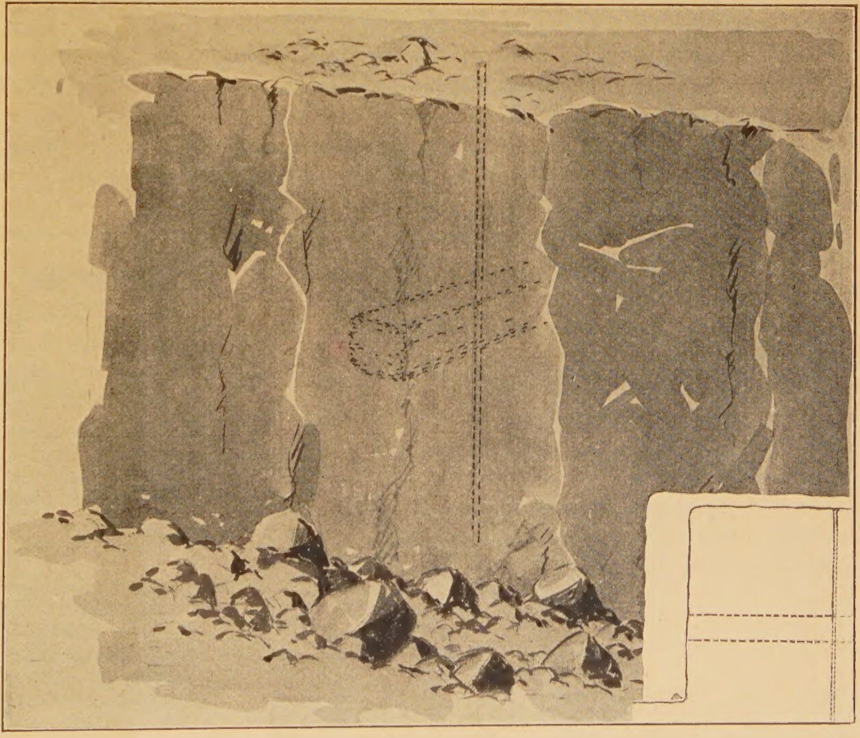
Shots Can Not Be Prevented

Nearly every explosives field man who has had much experience in quarry blasting can look back to at least one wild shot in his day. They are generally impossible to prevent because the weakness is entirely concealed behind the rock face, and they are just as likely to occur from a light charge of explosive as from the heavy one. For example, in a certain quarry some years ago a drill hole only 16 ft. deep was loaded with about 12 lb. of dynamite. The blast laid down the rock within 70 ft. of the face, with the exception that one fragment, weighing about 75 lb., was shot like a projectile a distance of nearly 700 ft.

Usually these wild shots do no particular damage, but occasionally, according to the law of the inherent cussedness of inanimate matter, a missile goes straight for the crusher, pump or other valuable equipment. Sometimes the slips occur, not at right angles to the face, but at an acute angle, in which case the projectiles fly off in a direction entirely unexpected.

Protection or Cover

Since there seems to be no way of preventing a wild shot or of telling when one is coming, the only thing to do is to have the machinery out of the way, or at least well protected; and to have all the men under safe cover. It is also a wise precaution, when blasting is done in the vicinity of highways, to stop motorists from venturing into the danger area, and to suggest to occupants of cars parked outside the supposed danger zone that they get out of their cars at the time of the blast. A number of people have been killed in the past few years from rocks striking automobiles. If the occupants had stood outside, in all probability they would have been able to dodge the projectiles.



Stage setting for a wild shot. Faults in quarry wall loosen piece of rock which well-drill blsat may shoot out as from a cannon

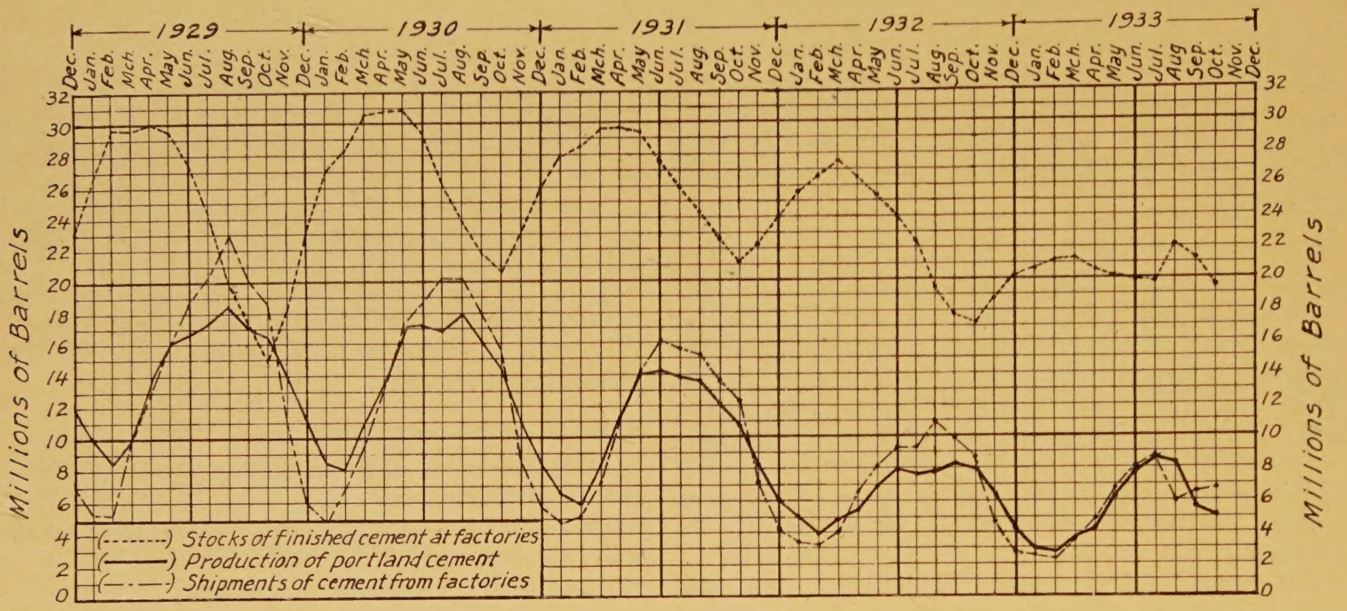
Cement Statistics for October

Relation of Production to Capacity (Per Cent)

	The Month	Twelve Months
October, 1933	22.1	24.5
October, 1932	34.6	29.6
September, 1933	25.5	25.5
August, 1933	35.9	26.5
July, 1933	37.6	26.3

Production, Shipments and Stocks of Finished Portland Cement (Barrels)

	1932	1933
Production, October	7,939,000	5,037,000
Shipments, October	8,743,000	6,750,000
Stocks at end of month	17.084,000	19,503,000
Production for year to date	65,799,000	55,175,000
Shipments for year to date	72,962,000	55,885,000



Consider Manganese in Place of Iron in Portland Cement

An article by O. Goffin and G. Mussgnug, published in *Zement* in the issues of April 27 and May 4, 1933, describes an investigation of the possibilities of replacing iron with manganese in portland cement manufacture. The May (1933) issue of *Building Science Abstracts* concludes that as the result of laboratory and full-scale burns of portland cement clinker from high manganese raw materials, the iron in portland cement can be replaced to a large extent by manganese.

In the manufacture of cement, manganese is just as valuable as iron as regards its chemical affinity to lime, its power of promoting sintering and reactivity of the raw mix and the strength developed by the clinker. With manganese contents above 5 per cent, however, strengths are somewhat reduced and considerable difficulties are experienced in burning. With clinker of the chemical composition of the material studied in this investigation the most favorable manganese content is between 2 and 4 per cent (as Mn_2O_3) and is given by the formula:

$$1 < \frac{Al_2O_3}{Fe_2O_3 + Mn_2O_3} < 1.6$$

In properly burned clinker the manganese is present as manganic oxide. Manganous oxide occurs in considerable amounts only in clinker with a very high manganese content. Clinkers containing manganic oxide are dark grey in color, those containing manganous oxide, blackish grey. Brown or pink shades occur only with lower oxides of manganese.

From the Patent Office

By J. KAPLAN
Patent Attorney, Washington, D. C.

Slag cement: Oscar Nickel, Mulheim-Ruhr, and Reinhold Markwitz, Duisburg, Germany. U. S. Pat. 1,834,799.—A mixture of about 3 to 20 per cent of burned unslacked lime, about 75 to 95 per cent of substantially dried water-granulated blast-furnace slag, and about 1 to 5 per cent of gypsum, is ground to the fineness of portland cement.

●

Hydraulic cement: P. T. Lindhard, Brooklyn, New York. U. S. Pat. 1,929,953, Oct. 10, 1933.—The device comprises a calcining section, a section for preliminary heating of raw material, means for delivering the heated raw material to the calcining section, means for delivering raw material and combustion gases from the calcining section to the interior of the shell, and an arrangement for utilization of the combustion gases.

Michigan's State-Owned Cement Plant

The finance committee of the Michigan state administrative board opened bids for the purchase of the Chelsea state-owned cement plant early in November, finding Lincoln F. Jay of Detroit high bidder with an offer of $35,000, according to the Lansing, Michigan, *Journal.*

The plant was originally purchased at the recommendation of Alex J. Groesbeck, former governor, who contended that cement producers had reached a price agreement. The state has the plant listed as an investment approximating $1,000,000.

Governor William A. Comstock and John K. Stack, Jr., auditor general, believe the state would profit by dismantling the plant and selling the equipment.

Judge Decides in Atlas' Favor

In a damage suit for $13,000 before the Workmen's Compensation Commission—Burbie Cunningham vs. the Atlas Portland Cement Company—for the death of the plaintiff's husband, Jasper D. Cunningham, the claim was denied recently by the commission. The case was appealed to the Ralls County (Missouri) circuit court. Judge Alford decided the case in favor of the defendant company. The plaintiff was represented by Rendlen, White & Rendlen and the defendants by Mahan, Mahan & Fuller.

No-Injury Records

The following no-injury reports for the Cement Industry, as prepared September 6, appeared in the October, 1933, News Letter of the National Safety Council:

1. Lehigh Portland Cement Co., Iola, Kansas. 2,361,146 man-hours. Unbroken August 11, 1933.
2. Nazareth Cement Co., Nazareth, Pennsylvania. 2,138,037 man-hours. Terminated April 21, 1932.
3. Alpha Portland Cement Co., Ironton, Ohio. 2,008,208 man-hours. Terminated July 28, 1933.

Each record consists of the number of continuous man-hours worked by the employees of the company without a disabling injury.

✦ PERSONAL ✦

Gen. Harry C. Trexler, chairman of the board of the Lehigh Portland Cement Company, and a widely known banker of Allentown, Pa., died in a hospital at Easton, Pa., on November 17 of injuries received in an automobile accident. He was 79.

Identified for many years with the development of the Lehigh region, he was president of the cement company from its organization until he relinquished the post for the one he held until his death.

R. R. Coghlan, formerly chemical engineer for the Marquette Cement Manufacturing Company, has become associated with the Dewey and Almy Chemical Company of Cambridge, Mass. He is at present engaged in research work for this company.

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MILL EQUIPMENT

Photo-Electric Relays

For certain control problems, General Electric relays are said to offer many definite advantages over more conventional control devices. Several forms of photo-electric relays are available to meet the various conditions of application, including devices to operate from both A.C. and D.C. supply lines; those particularly designed for high-speed response and high sensitivity; and those particularly designed for outdoor service.

In addition, light-source units for use in conjunction with the photo-electric relays are available. All units may be operated either to close or to open a circuit upon suitable light change.

Among the varied types of application, a typical case in which relays control is the automatic weighing processes for cement. For purposes other than the control is regulation of water level in oil tanks. They are also employed in counting applications, such as bags of cement.

Catalog CR7505 is available to those interested.

New Portable Cutting Machine Announced

A portable cutting machine weighing but 43 lb. has been announced by the Linde Air Products Co., 30 East 42nd Street, New York, as an addition to its Oxweld line of apparatus. It is known as the Secator.

Combining the portability of a blowpipe with the accuracy and finish of a cutting machine, the Secator is said to make it possible to do high-quality cutting anywhere in the shop or in the field.

Essentially it consists of an Oxweld Type C-14-H blowpipe (especially designed for it) mounted on an electrically driven, air-cooled, dust-proof chassis. It is equipped with a direct drive and runs either on a 1½-in. angle-iron track, furnished with it, or on any relatively smooth plate. When operated on the track, it does straight-line cutting automatically.

Hot Water Heater Is Made Applicable to Mills

A large capacity electric water heater is announced by the General Electric Co. as now available to the industrial trade. Used with large storage tanks, it is said to be particularly adapted to the larger production requirements and the storage principle will permit night storage operation.

The heater is of 30 gal. capacity and is available in electrical ratings of 10, 20, 30, 40, 50 and 60 kw. Capacity in terms of gallons of hot water per hour as well as other data are shown in a curve contained in a 4-page leaflet issued by the General Electric Co., Schenectady, N. Y. This is GEA-1800.

Cement Code Signed!

As this issue goes to press (November 27) a wire from our Washington representative announces that President Roosevelt had just signed the cement manufacturing code at Warm Springs, Georgia.

Copies can be obtained, as soon as printed, from the Superintendent of Documents, Washington, D. C., at 5 cents each.

Increase in Ratings

Allis-Chalmers Texrope V-belt drive with one or both sheaves "Texsteel" are now available from ¼ to 15 h.p. suitable for many industrial applications. Texsteel sheaves are grid type construction, with accurately formed heavy gage steel sections electrically welded at web and rim. Outer rims are rolled for protection, good appearance and strength. Integral bushings or solid bored hubs are standard. Texsteel sheaves, the manufacturers say, are well-balanced, light in weight and practically indestructible.

Texsteel Texrope drives are said to be particularly economical where large numbers of V-belt drives are required or, as standard equipment for machinery manufacturers. The Texsteel sheaves have an attractive aluminum finish.

Industrial Literature

Copes Publications

The Copes Catalog of Flow, Level and Pressure Controls has just been issued by the *Northern Equipment Co.*, Erie, Pa. This is a 16-page publication, well illustrated with both photographic and diagrammatic views.

A second publication comprising 40 pages is that entitled *The Copes Catalog of Feed Water Regulators and Allied Equipment.*

Shaft-Coupling Catalog

A new illustrated catalog has been completed by Link-Belt Company, Indianapolis, on flexible shaft-couplings. Three different types are tabulated and priced, with special emphasis of type "RC" which employs Link-Belt Silverlink Roller Chain for flexibly connecting the two toothed coupling halves. Both revolving and stationary types of automatic-lubricating casings are included.

A copy of the new book is available to anyone requesting it on a business letterhead.

Field Activities

Announces New Appointments

James Cleary, who has been a sales executive of the *Combustion Engineering Company, Inc.*, for many years, has been appointed manager of the Philadelphia sales district with headquarters at 1616 Walnut Street, Philadelphia.

Fred L. Farrell, long identified with sales work in this field, and previously associated with this company in the same office he now holds, has been appointed manager of the New England sales territory with headquarters in the Chamber of Commerce Building, Boston.

G. O. French, previously New York district sales manager of the Air Preheater Corporation, has been engaged as a sales engineer specializing on sales work in connection with the company's fire-tube boilers and all special shop work such as oil refinery equipment, chemical equipment, special alloy vessels, tanks, plate work, etc.

International Elects Officers

At a recent meeting of the Board of Directors of International Cement Corporation *Richard F. Hoyt* was elected chairman of the board and chairman of the Executive Committee to succeed the late F. R. Bissell.

Charles L. Hogan, formerly senior Vice-President was elected president of the corporation, to succeed Holger Struckman, who died suddenly on November 17 in Copenhagen after a short illness.

Traylor Opens Office in Little Rock

The Traylor Engineering and Manufacturing Company, Allentown, Pa., with district offices in New York, Chicago, Los Angeles and Seattle, announces the opening of a new district office at Little Rock, Ark.—address P. O. Box 748—to serve western Tennessee, Arkansas, Louisiana, Texas, Oklahoma and Kansas.

The new office is in charge of B. W. Traylor, who has been connected with the company for many years.